BUREAU OF WATER

South Carolina Department of Health and Environmental Control

OCEAN WATER QUALITY

MONITORING AND NOTIFICATION PROGRAM

Revised October 2003

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www.scdhec.gov/water/html/beachmon.html

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MONITORING AND NOTIFICATION PROGRAM

South Carolina's bathing beaches are important components of the state's tourism industry. The South Carolina Department of Health and Environmental Control (DHEC), in conjunction with local governments, regularly monitors coastal beaches for the bacterial indicator enterococci to assure residents and tourists that the water is safe for water contact activities. The goal of this program is to allow the public to make informed decisions concerning recreating in waters presenting a potential for adverse health effects.

HEALTH RISKS

The most common outcome measure in relation to swimming in potentially contaminated ocean water is acute gastroenteritis and diarrhea from accidental ingestion. While respiratory and other infections are possible, the likelihood of acquiring certain potentially serious pathogens such as Salmonella typhi and poliovirus is extremely low to non-existent in US coastal waters. Most illnesses associated with swimming are neither protracted or life threatening, but can result in discomfort, inconvenience, and potentially significant direct and indirect medical costs. No studies have been conducted on South Carolina ocean water to relate bacterial densities with actual incidence of swimmer illness. Although not everyone will become ill after swimming in contaminated water, the risk of illness has been correlated with increasing bacteria densities.

HISTORICAL PERSPECTIVE

Until 1980, DHEC collected water quality samples from the surf. There were 19 stations: 16 in the Grand Strand area; and one each at Folly Beach, Sullivans Island, and Isle of Palms. Samples were collected once per month during the months of May through October. A review of the data collected for the final 5 years of sampling shows no indication of violations of the State water quality standard for swimming. When DHEC stopped sampling the surf stations, there were new initiatives to monitor nonpoint source pollution statewide, and resources were focused there. While the surf data were useful for determining overall water quality, they were not useful for advising swimmers, due to the monthly sampling protocol.

During 1991-1993 the United States Geological Survey monitored Withers Swash in Myrtle Beach, tributaries to it, and the ocean near the swash for fecal coliform bacteria. The study showed increased levels of bacteria during wet weather periods. The monitoring in the ocean was limited, but did not show a persistent problem. Bacteria were elevated in the surf at the immediate confluence with Withers Swash, but were at acceptable levels 70- 100 feet on either side of the Swash. This suggested dilution and dispersion of the storm water and its contaminants.

During the summer of 1996 there was increased interest by DHEC in the water quality of South Carolina's ocean beaches, especially in the Grand Strand area. A report by the Natural Resources Defense Council and articles in local newspapers sparked criticism

because South Carolina did not have a program in place to monitor our ocean water quality and advise swimmers appropriately. In response to this interest, DHEC, in conjunction with several local governments, conducted a study in 1997 to determine levels of bacteria in the ocean water of South Carolina beaches under varying site and environmental conditions. DHEC used this data and experience to develop a model sampling plan. However, due to the logistics of sampling, holding times for samples, laboratory space, and funding, DHEC could not carry out the model plan.

In 1998, the South Carolina General Assembly allocated some non-recurring funds to DHEC for ocean water quality monitoring. These funds were used to carry out the sampling plan established by the 1997 study for the Waccamaw District (Horry and Georgetown counties). Routine monitoring in all three coastal districts (Waccamaw, Trident, and Low Country) began in 2000 and has continued each year to present with slight modifications.

BEACH ACT

In October 2000, the Beaches Environmental Assessment and Coastal Health (BEACH) Act was signed into law, amending the Clean Water Act. In part, this amendment allows the Environmental Protection Agency (EPA) to award grants to assist state and local governments in developing and implementing monitoring and public notification programs for coastal waters. To date, South Carolina has received grant monies for fiscal years 2002 and 2003. This grant money has allowed South Carolina to continue to carry out a comprehensive monitoring and notification plan despite severe budget restraints. As a condition of these grants, DHEC must implement a risk-based monitoring and public notification program that is consistent with performance criteria published by EPA under the act.

RISK-BASED BEACH EVALUATION AND CLASSIFICATION

Risk-based beach evaluation and classification is a means to efficiently allocate monitoring and public notification resources to waters on the basis of use and potential disease risk. In order to establish beach ranking, DHEC reviewed available information concerning intensity of beach use, potential risk to public health, and other applicable factors. A three-tier system was used for this process, with Tier 1 being the highest priority. Tier rankings for each beach are given in Attachment 1.

Intensity of Beach Use

Intensity of beach use was based on accessibility of the beach, available governmental data, and observations of actual use. Accessibility encompassed factors such as public or private beach, number of access points, amount of available parking, and if accessible by foot or by boat only. Information concerning access was gathered from the South Carolina Department of Natural Resources and DHEC's Department of Ocean and Coastal Resource Management. Coastal governments' tourism and chamber of commerce websites were accessed for additional information concerning use. The 2000 Census and the South Carolina Statistical Abstract 2001-2002 (SC Budget and Control

Board) were also examined for data concerning each coastal county. Input concerning actual use was gathered from sample collectors, district program managers, and shellfish sanitation managers and patrolmen. Input was also gathered from government staff and the public at informational meetings held in each coastal district.

Potential Risk to Public Health

For those beaches previously monitored, risk was assessed based on the presence of known pollution sources and the number of advisories and total beach-mile-days of advisories in the 2002 swim season. For those beaches and points of access not previously monitored, risk was inferred based on several factors. These factors included water body classification, potential for point and non-point source pollution, historic water quality of similar areas, type of use (likelihood of ingesting water), and susceptibility of user population.

Other Factors

Other factors considered in establishing beach priorities were the importance to the local economy and tourism industry, public opinion, and public input. South Carolina's Atlantic Ocean coastline is a well-known feature of the State drawing millions of visitors annually and boosting local economy. Protecting public health through monitoring of this area is a public expectation as can be seen through the abundance of news articles and environmental group publications. Due to these factors, oceanfront beaches were given priority in the ranking scheme.

METHODS AND ASSESSMENT PROCEDURES

Because it is difficult and costly to directly detect the many different pathogens and parasites the may be present in water, fecal bacteria is used as an indicator of the possible presence of disease-causing organisms. According to EPA, enterococcus bacteria are the best indicator for the pathogens that may be present in ocean water. The BEACH Act requires that all coastal states adopt EPA's recommended water quality standards (enterococci for marine water) by April 2004. South Carolina has used enterococci standards since the inception of the monitoring program.

For swimming in ocean water, EPA recommends a geometric mean of no more than 35 enterococcus bacteria per 100 milliliters of water. EPA believes that this limit is appropriate and represents an acceptable level of risk. The limit is intended for comparison with the geometric mean of a statistically significant number of samples: at least five samples equally spaced over a 30-day period.

EPA also recommends setting a single-sample maximum based on the intensity of beach use and observed local variability in bacteria densities. This single-sample limit is more appropriate to use for swimmer advisories than the geometric mean, since results can be reported within 24 hours of sampling. As an example, EPA calculated a limit of 104 enterococcus bacteria colony forming units per 100 milliliters of water (CFU/100mL) for a heavily used, (*bacteria*) sewage-contaminated beach during dry weather. For the same

beach used infrequently, the calculated limit was 500 CFU/100mL. South Carolina uses each of these single sample limits as triggers for further action.

The Enterolert Quantitray analysis is used in the ocean water quality monitoring program. This method was chosen as a rapid and simple means of identifying enterococcus presence in coastal waters. This method has been recognized by EPA as an acceptable method in these determinations.

TIERED MONITORING PLAN

The objective of South Carolina's beach monitoring program is to protect public health through the issuance of advisories based on accurate, representative sampling. This sampling design and monitoring implementation plan has been developed to describe the frequency and location of monitoring and assessment of South Carolina's coastal recreation waters.

A study to determine levels of bacteria in the surf of South Carolina beaches under varying site and environmental conditions was conducted with ten local governments in 1997. One sampling site was selected for each two to three miles of beach, and one each at the furthest reaches of accessible beach within each participant's jurisdiction. In areas with swashes or storm water discharges to the beach, sites at their confluence with the ocean, and 100 feet on either side, were selected. At a minimum, the two sites with the highest estimated storm flows in each municipality or jurisdiction were included. Samples were collected in dry weather at high and low tide and in wet weather at high and low tide. "Dry" weather meant that three or more days had passed since the last rain. "Wet" weather samples were collected within three hours of the first rain of 0.1 inches or more, following a dry period. Over 1,400 surf and storm water samples were collected during this study. Major finding of the study were:

- In areas with no storm water outlets or swashes, the geometric mean did not exceed 35 CFU/100mL and all individual sample results were less than 104 CFU/100mL regardless of weather conditions.
- Beaches with discharges from swashes and/or storm water outlets showed variability based on weather. Dry weather samples from these areas did not exceed the EPA recommended geometric mean (35 CFU/100mL). Wet weather effects on surf bacteria varied from site to site and with rainfall amount; results from many samples exceeded the single-sample limit. In general, highest single-sample densities were associated with rainfall amounts greater than one inch.

Routine monitoring of beaches from 1998 through present has validated the previous points and has added to our understanding of beachfront water quality dynamics. This monitoring has shown that beaches with associated storm water runoff (Tier 1 beaches) have the highest counts in the period three hours before to three hours following ebb tides. Based on the 1997 study and on subsequent routine monitoring efforts, the following monitoring plan has been developed.

Table 1. Tiered Monitoring Plan

		Tier 1	Tier 2	*Tier 3
A. When to Conduct Basic Sampling		April 15 - October 15 Once per week Three hours before to three hours after low tide	April 15 - October 15 Twice per month Random tidal stages	April 15 – October 15 Once monthly Random tidal stages
B. When to Conduct Additional Sampling	Rainfall events	Additional samples will be taken following rainfall events for public health protection and to aid in development of a predictive model.	N/A	N/A
	After a water quality standard is exceeded	If any sample exceeds the action level a repeat sample will be taken within 24 hours of result notification.		
	After a sewage spill or pollution event	Sampling will be conducted as soon as possible following a sewage spill or other pollution event. At district manager's discretion, beaches will be preemptively placed under advisory until satisfactory sample results are received.		
	Reopening after advisory or closure	Additional samples shall be taken following an advisory until sample results fall below the action level and advisory is lifted.		

*Tier 3 beaches are not currently monitored.

Sampling sites are located every two to three miles along the beachfront based on public access points. Additional sites are located near problem areas such as swashes and storm drain outfalls. Samples are collected at knee depth (approximately two feet) to best represent the area where recreation normally occurs.

PUBLIC NOTIFICATION AND RISK COMMUNICATION PLAN

South Carolina issues two types of advisories, water quality exceedance advisories and preemptive advisories. Advisories are posted as necessary May 15 through October 15. DHEC and local governments also post permanent warnings in specific areas.

Water Quality Exceedance Advisory

If a routine sample at a Tier 1 or Tier 2 beach exceeds 104 CFU/100 mL, a repeat sample is collected within 24 hours. If the repeat sample also exceeds 104 CFU/100 mL, an

advisory is issued. If any single routine sample exceeds 500 CFU/100 mL (Tier 1, 2, or *3), an advisory is immediately issued.

*Tier 3 sites are not currently monitored.

Preemptive Advisory

Due to the time required for analyses, it may not be protective of public health under certain circumstances to wait on analytical results. It is known from previous monitoring efforts that certain areas routinely experience elevated bacteria levels following rainfall. Preemptive rainfall advisories may be issued for these areas at the discretion of the district program manager. Ocean water samples are taken to confirm the advisory. A predictive model is currently under development to refine the predictive rainfall advisory process. Preemptive advisories may also be issued due to extreme weather events such as hurricanes or tropical storms or due to pollution events such as sewage spills.

Public Notification

In the event of an advisory, signs are posted at conspicuous areas on the affected beach. If feasible, signs are posted at points of entry to the affected beaches. Beach advisory signs state the following:

SWIMMING ADVISORY ISSUED FOR THIS AREA
A Swimming Advisory Has Been Issued By (local jurisdiction) and
The SC Department of Health and Environmental Control for This Section
of Beach. High Bacteria Levels Have Been Detected In This Section
of The Beach, and Swimming Is NOT Advised Until Bacteria Levels
Return to Normal

The responsible district staff member contacts the appropriate municipality. Local media outlets are contacted by the district program manager or the municipality, as previously negotiated. A copy of the advisory is sent by electronic mail to the program coordinator and each coastal district office (Waccamaw, Low Country, Trident). The advisory includes as a minimum:

- date issued
- the location of the advisory ex: 200 feet above and below 16th Avenue North
- percentage of the total beach affected by this advisory
- reason for the advisory (if known) ex: heavy rainfall or sewer line break
- text of the advisory: A Swimming Advisory Has Been Issued By (local jurisdiction) and The SC Department of Health and Environmental Control for This Section of Beach. High Bacteria Levels Have Been Detected In This Section of The Beach, and Swimming Is NOT Advised Until Bacteria Levels Return to Normal
- district contact number

DHEC also maintains a web site that is useful for communicating information to residents, tourists and other agencies, *www.scdhec.gov/water/html/beachmon.html*. This website contains program information, frequently asked questions, and program contact

information. The web site also features a link to the Earth 911 Beach Water Quality website. The Earth 911 website (*www.earth911.org*) is updated by DHEC staff upon receipt of water quality results. Sample sites under advisement show up as red on the website, areas not under advisement are green. The website also offers a printable beach status report.

Procedure for Removing Advisories or Warnings

An advisory is removed when sample results confirm that enterococci levels are within acceptable limits (<104 CFU/100mL). The municipality is notified of the sample results, the website is updated by DHEC staff, the sign is removed, and media outlets are contacted by either DHEC staff or the municipality.

Permanent Warnings

Permanent warnings are issued at specific swashes and storm water outfalls based on continuous poor water quality in these areas, especially following rainfall. Permanent signs are posted at these sites warning that swimming or playing in runoff is not recommended.

The following notice is permanently posted in swash areas:

CAUTION

Following rainfall, this area may have elevated levels of bacteria due to storm water runoff. Swimming is not recommended within 100 ft in each direction. Wading, fishing, and shell hunting do not present a risk. For more information call (local jurisdiction) or SC Department of Health and Environmental Control

The following notice is permanently affixed to storm water outfalls:

This Is a Storm Water Pipe

CAUTION

Swimming or playing in storm water runoff on the beach is NOT recommended. Wading, fishing, and shell collecting do not present a risk. For more information, contact (local jurisdiction) or the SC Department of Health and Environmental Control.

APPENDIX A

BEACH RANKING AND MONITORING SITES

Tier 1 Beaches	**Number of Sample Sites**
Waccamaw District	
North Myrtle Beach	10
White Point Swash	1
Briarcliffe Acres	2
Arcadia Beach	3
Myrtle Beach	12
Springmaid Beach	1
SC State Park and Campgrounds	4
Surfside Beach	7
Garden City Beach (Horry County)	2
Tier 2 Beaches	
Waccamaw District	
Garden City Beach (Georgetown County)	1
Huntington Beach	2
Litchfield Beach	3
Pawleys Island	3
Debordieu Beach	2
Trident District	
Isle of Palms	8
Sullivans Island	3
Folly Beach	8
Kiawah Island	5
Seabrook Island	2
Low Country District	
Edisto Island	11
Harbor Island	3
Hunting Island	6
Fripp Island	5
Hilton Head Island	14
Total Monitoring Sites	**118**

Tier 3 Beaches

Tier 3 beaches consist of small islands accessible by boat only and public access points, such as public boat ramps and marinas, within coastal waters but not on the oceanfront. Tier 3 beaches are not currently monitored due to insufficient resources. Limited monitoring of these areas may occur in the future if funding and staff resources permit.

APPENDIX B

CONTACT INFORMATION

Websites

SC DHEC – www.scdhec.gov/water/html/beachmon.html
Earth 911 – www.earth911.org

Contacts

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